Indiana Department of Education
-STEM Certified Schools-

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Webinar is being recorded and will be posted on the IDOE STEM Education webpage

Agenda

- Setting the stage for STEM education
- What is STEM
- Role of STEM Certified Schools
- Process for being STEM Certified

What is STEM?

- Boundaries between science, technology, engineering, and math are removed or blurred
- The four disciplines are interdependent
- In blending science, technology, engineering, and math, STEM education seeks to create 21st century learning opportunities and skill development for all students

Indiana's Definition of STEM

STEM education is an intentional, metadisciplinary approach to teaching and learning, in which students uncover and acquire a cohesive set of concepts, competencies, and dispositions of science, technology, engineering, and mathematics that they transfer and apply in both academic and real-world contexts, in order to be globally competitive in the 21st Century."

-Rider-Bertrand 2007

The STEM Need?

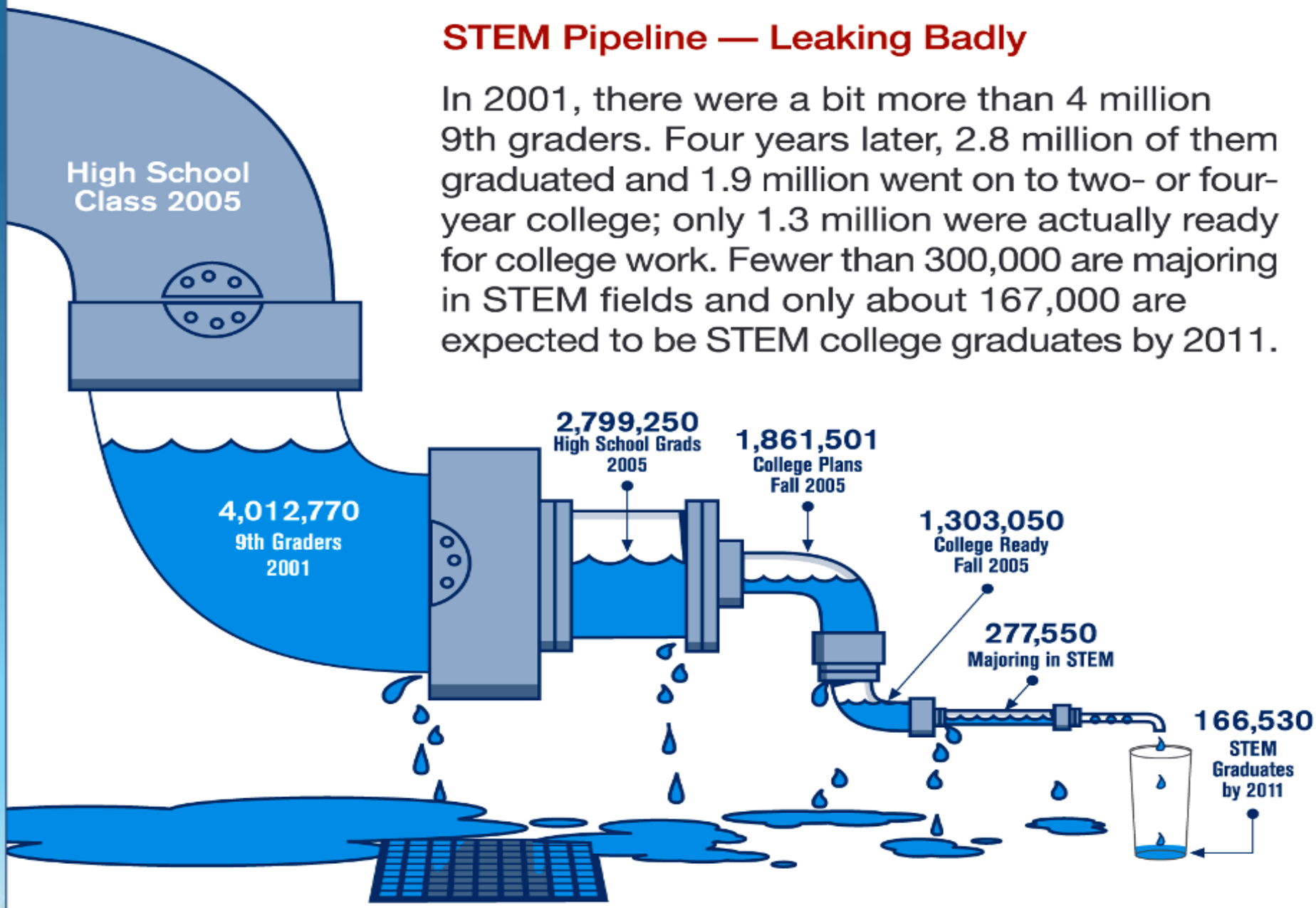
- State and National STEM Trends
- Gender and Racial Gaps
- STEM Initiatives around the state and country

Why the focus on STEM?

- Increasing economic pressures
- Competition in the global marketplace
- Recognition of the importance of STEM for innovation and development

STEM Pipeline — Leaking Badly

In 2001, there were a bit more than 4 million 9th graders. Four years later, 2.8 million of them graduated and 1.9 million went on to two- or four-year college; only 1.3 million were actually ready for college work. Fewer than 300,000 are majoring in STEM fields and only about 167,000 are expected to be STEM college graduates by 2011.

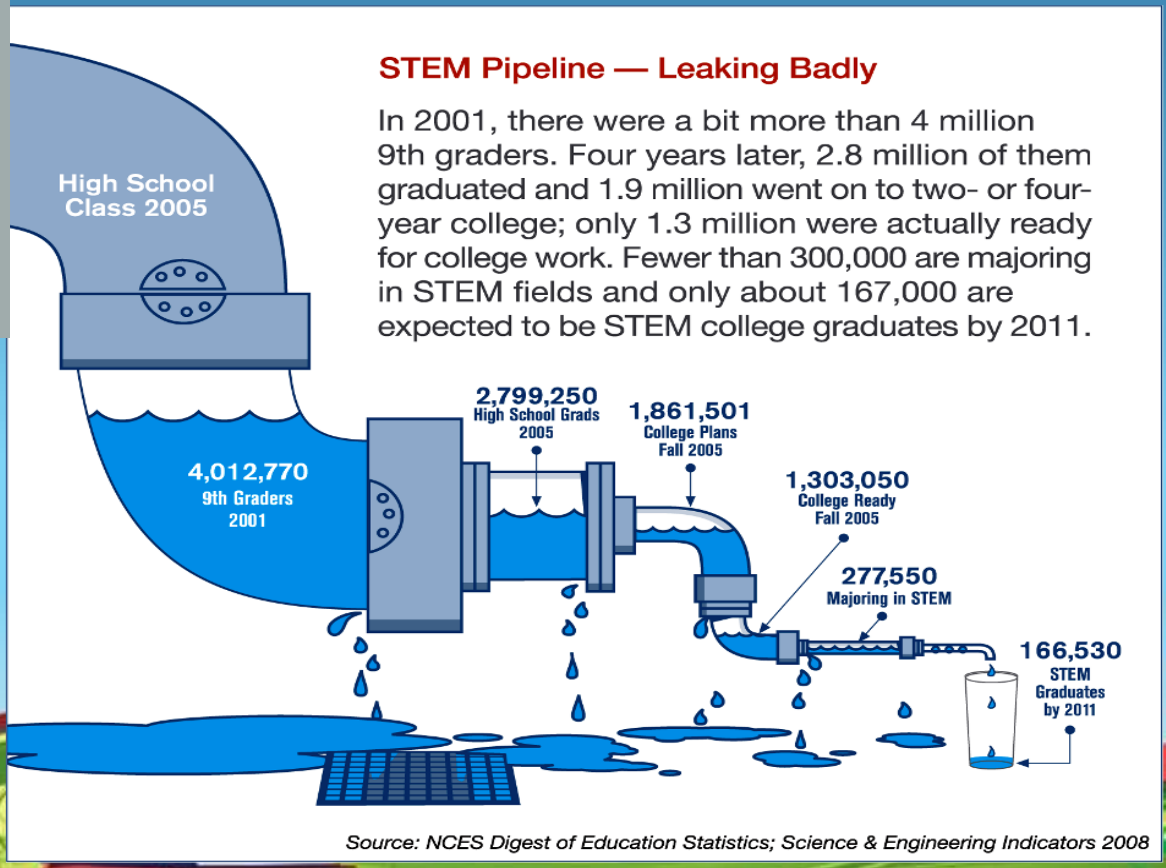


Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008

Pre-K

Elementary School

Middle School



Why is STEM Important to Indiana?

VITALSIGNS

INDIANA

Business leaders in Indiana have sounded an alarm. They cannot find the science, technology, engineering and mathematics (STEM) talent they need to stay competitive. Students' lagging performance in K–12 is a critical reason why.

To address this challenge, Indiana is raising the bar. The state has joined 44 others in adopting high math standards for K–12—the Common Core State Standards—and is working with other states to create rigorous assessments aligned to those standards. These are promising steps, but the state must do more to succeed amid profound political, practical and financial challenges.

Indiana will need to ensure that schools and students have opportunities to meet higher expectations. Students have made progress in math over the past decade. Yet not enough students—least of all minorities—get the chance to learn challenging content that prepares them for college and careers. Gender disparities are also troubling: Eighth-grade boys outperform girls in science, and women earn about a fourth of college certificates and degrees in STEM fields. Nearly two-thirds of Indiana community college students require remediation in math, costing the state millions of dollars.

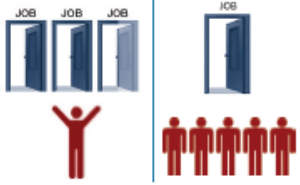
To its credit, the state stretches its math and science education dollar farther than other states do. Smart investments will be critical as business leaders work with educators and states to tackle new reforms in lean times.

STEM SKILLS ARE IN DEMAND

In Indiana, STEM skills have stayed in demand even through the economic downturn.

STEM: **2.4 jobs** for every **1 unemployed person**

Non-STEM: **5.0 unemployed people** for every **1 job**



CAN INDIANA MEET THE DEMAND FOR STEM SKILLS?

Students have made real academic strides in most states, but no state is on track to getting all students the STEM skills they need to succeed in college and careers. Low-income and minority students lag farthest behind.

Students have improved in math

Since 2003, eighth graders in Indiana have made some gains on the National Assessment of Educational Progress (NAEP), also known as "the nation's report card." Yet most still have far to go to reach a score of 299, NAEP's cutoff for "Proficient" performance.

8th Grade NAEP scale scores, 2003 & 2011

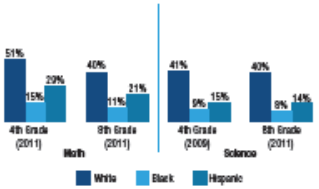
	NAEP Scale Score		Change Since 2003	
	2003	2011	IN	Most Improved State
All	281	285	+4	+17 (DC)
Low Income	225	242	+7	+19 (MA)
White	286	290	+3	+17 (HI)
Black	251	264	+13	+19 (NJ)
Hispanic	261	275	+14	+24 (AR)

Totals may not sum due to rounding errors

Closing achievement gaps must remain a priority

No state has closed the persistent achievement gaps among racial and ethnic groups.

Percentage of students scoring at or above proficient in math and science, 2009 & 2011



CHANGE THE EQUATION IN PARTNERSHIP WITH the American Institutes for Research.

For the complete state report, methodology and sources, visit changetheequation.org/stem-vital-signs.

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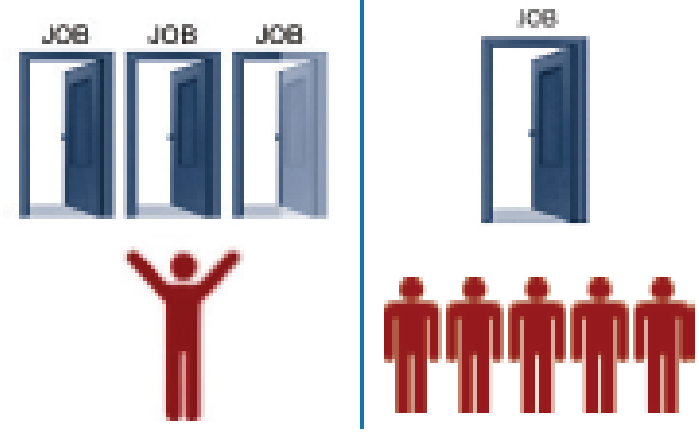
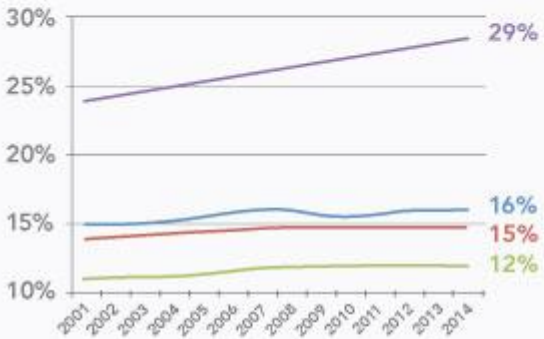


http://changetheequation.org/

Indiana STEM Vital Signs

- 2.4 STEM jobs for every unemployed STEM person, 5 unemployed people for every 1 job outside of STEM
- Only 12% of college graduates receive a degree in the STEM fields
- 64% of Indiana's first time community college students need remediation in math
- In 1994 science was taught 3 hours per week in elementary classrooms, now only 2 hours. That's 24 minutes a day!

African Americans and Latinos have lost ground in STEM



African American/Latino Percentage of:

- the U.S. working-age population
- the advanced manufacturing workforce
- the computing workforce
- the engineering workforce

Source: Change the Equation, "The Diversity Dilemma," 2015

CHANGE THE EQUATION

Women have seen no improvement in STEM since 2001

Women remain as scarce as ever in engineering, computing, and advanced manufacturing.

Women as a percentage of the:	2001	2014
Engineering Workforce	25%	24%
Computing Workforce	36%	36%
Advanced Manufacturing Workforce	19%	18%

Source: Change the Equation, "The Diversity Dilemma," 2015

CHANGE THE EQUATION

MINORITIES LOSING GROUND

14 percent of U.S. Bachelor's Degrees in STEM in 2012 were awarded to people of color, even though they represent *33 percent* of the college-age population. People of color received only *9 percent* of Master's degrees and a mere *6 percent* of doctorates.

CHANGE THE EQUATION STEMtistics

86% of engineers +74% of computer professionals {*are men*}

CHANGE THE EQUATION STEMtistics WORKFORCE

What do STEM schools do?

Indiana STEM School Attributes

1. Infrastructure
2. Curriculum
3. Instruction
4. Extended Learning

State Certified STEM School / Program

- The IDOE began providing an IDOE approved STEM Certification for schools that want to be recognized as STEM in Spring 2015 (cohort 1)
- Our Goal is to extend a STEM school network promoting collaboration of best practices in STEM classes
- The application cycle opens in the fall of the school year
- STEM Certified School vs STEM Certified Program

Purpose of Recognizing STEM Schools

- Increase the number of our graduates that are prepared to enter college and careers in the science, technology, engineering, and mathematics fields
- Form a network of IDOE recognized STEM schools that will be able to share resources and best practices in addition to collaborating on professional development, standards and curriculum
- IDOE STEM certified schools will have credibility within the community to enable partnerships with STEM businesses and industry
- Publically recognize the great and challenging work our schools are doing to educate our children for the 21st Century

What does a STEM classroom look like?

A STEM classroom is a non-traditional classroom that shifts students away from learning discrete bits and pieces of phenomenon and rote procedures but works toward investigating and questioning the interrelated facets of the real world.

The Teacher's Role

"The teacher is not in the school to impose certain ideas or to form certain habits in the child, but is there as a member of the community to select the influences which shall affect the child and to assist him in properly responding to these. Thus the teacher becomes a partner in the learning process, guiding students to independently discover meaning within the subject area."

-John Dewey 1897

How do STEM students perform?

STEM education aims to develop a student's ability to think logically, solve problems, innovate in both academic and real-world contexts, engage in inquiry, collaborate with peers, and self-motivate.

Key Elements of Effective Instruction

1. A coherent set of standards and curriculum
2. Teachers with high capacity to teach in their disciplines
3. A supportive system of assessment and accountability
4. Adequate instructional time
5. Equal access to high-quality learning opportunities

School Conditions that Support Learning

1. School leadership as the driver for change
2. Professional capacity of faculty and staff
3. Parent-community ties
4. Student-centered learning climate
5. Instructional guidance for teachers

Process of Certification

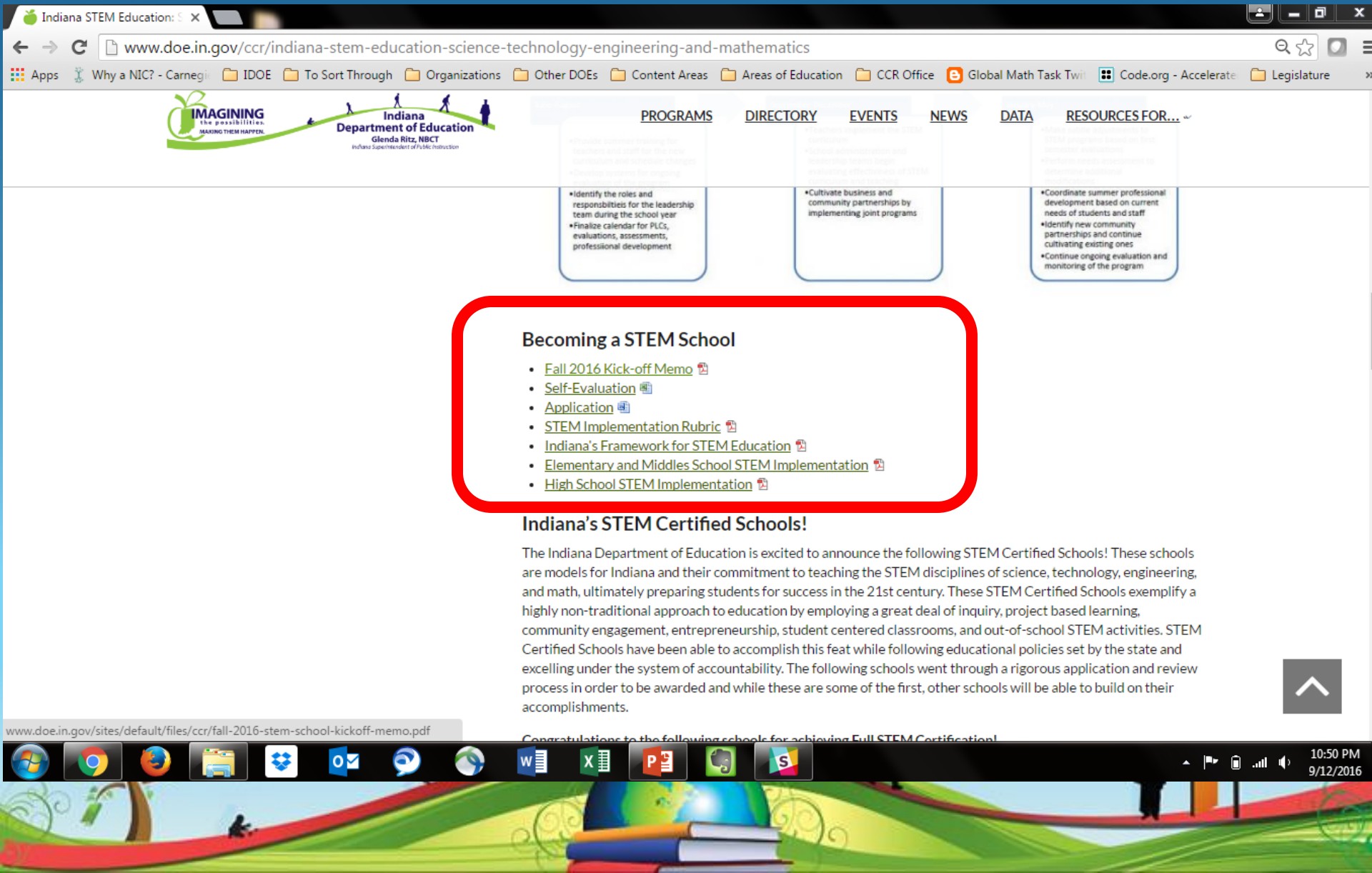
- **Step 1:** School should perform a self-evaluation using the STEM School Rubric and submit the pre-application to the IDOE STEM Coordinator.
- **Step 2:** A representative from the IDOE will contact you to schedule an initial conversation (i.e. phone call, skype, or if schedules permit a visit).
- **Step 3:** School makes adjustments based on self-evaluation and STEM Coordinator recommendations to determine level of preparedness for full application.
- **Step 4:** Complete the full application and submit to the STEM Coordinator. (By 4:30 PM on December 16th)

Process of Certification

- **Step 5:** Site visit to the school from the STEM review team consisting of community/business representatives and/or the Indiana Department of Education
- **Step 6:** Upon completion of the site visit, the STEM review team will review your application and compare it with the evidence and supporting documentation from the site visit.
- **Step 7:** If recommended for certification, school will develop an award ceremony where the IDOE will present a banner.

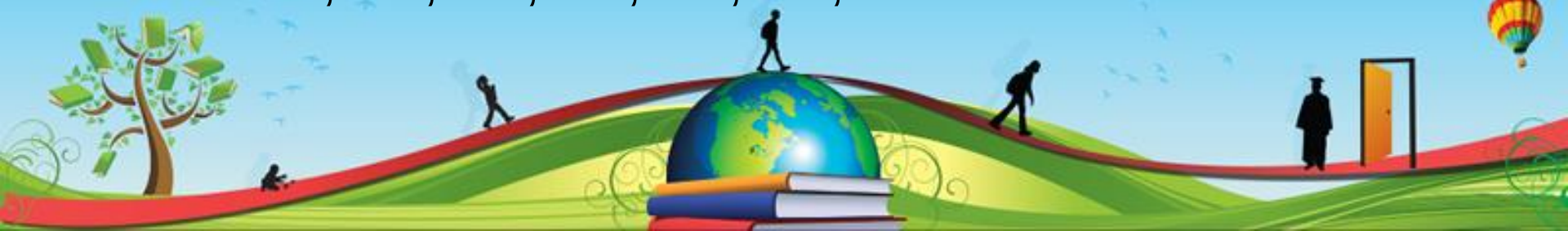
All certified STEM schools will be expected to reapply for certification every 5 years. Evidence of growth in the STEM attributes will be expected.

IDOE STEM Education Webpage



Self- Evaluation Using the STEM Implementation Rubric

- School will evaluate themselves in four areas:
  - Infrastructure – 8 Attributes
  - Instruction – 6 Attributes
  - Curriculum – 5 Attributes
  - Extended Learning – 3 Attributes
- Attributes have detailed descriptors that show what level of implementation the school is currently achieving
- STEM Certified School will demonstrate full implementation of all the Indiana Department of Education Essential STEM Attributes
  - 1.1, 1.3, 1.5, 1.8, 2.3, 3.5, 4.3



STEM Implementation Rubric

- **Full STEM Implementation:** Highest level of implementation of a STEM program
- **Approaching STEM Implementation:** Quality program meeting expectations
- **Developing STEM Implementation:** Program has met some components, but still needs further development
- **Initial STEM Implementation:** STEM program discussions have occurred and program implementation in infancy

STEM Implementation Rubric – Infrastructure –

1 – Infrastructure: <u>Is a structure and process in place to support the program's mission, vision, and goals</u>? STEM school requires several leadership teams that collaborate and dialogue frequently about the program's design and effectiveness. Teachers are highly collaborative and community members are included in decision-making.

INDIANA DEPARTMENT OF EDUCATION STEM ATTRIBUTES	Initial IMPLEMENTATION	Developing IMPLEMENTATION	Approaching IMPLEMENTATION	FULL IMPLEMENTATION
1.1 Leadership Teams at the district and school levels				
1.2 School schedules				
1.3 Community Engagement				
1.4 School Environment				
1.5 Technology Resources				
1.6 Data (state, district, school, classroom)				
1.7 Evaluation				
1.8 Equity				

Essential STEM School Standard 1.1: Leadership Teams

– Infrastructure: STEM programming requires leadership teams that collaborate and engage in dialogue frequently about the STEM program's design and effectiveness. Teachers are highly collaborative and community members are stakeholders in decision---making. Is a structure in place that supports the program's mission, vision, and goals?

Key Element	Initial Implementation	Developing Implementation	Approaching Implementation	Full Implementation	Description of your program/Supporting Documentation
1.1 Leadership Teams at the district and school levels	*-Administrative leadership and/or STEM teacher teams have determined the program's purpose and content* *---Leadership provides support to STEM teacher teams by allocating resources towards implementation and professional development* *---Decision making is made by less than 25% of staff*	*-Administrative leadership provides support to STEM teacher teams by allocating resources towards implementation and professional development* *---STEM teacher teams meet with administration regularly to discuss program implementation.* *--- Decision making is made by 25---50% of staff*	*-STEM leadership team in place to define and monitor and evaluate entire program* *---PLCs or teacher teams address expectations of program set by the leadership team.* *---Teams meet regularly to discuss program goals and progress, research, best practices, and opportunities for improvement.* *--- Decision making is made by greater than 50% of the school's staff*	*-STEM Leadership team in place to define, monitor, and evaluate entire program* *---PLCs and teacher teams address specific expectations of the program set by the leadership team* *---Leadership teams meet regularly to discuss research, best practices, successes, and opportunities for improvement towards STEM program goals.* *--- Decision making is made by all school staff, classroom, and special area teach...*	

Essential STEM School Standard 1.3: Community Engagement

– Infrastructure: STEM programming requires leadership teams that collaborate and engage in dialogue frequently about the STEM program's design and effectiveness. Teachers are highly collaborative and community members are stakeholders in decision---making. Is a structure in place that supports the program's mission, vision, and goals?

Key Element	Initial Implementation	Developing Implementation	Approaching Implementation	Full Implementation	Description of your program/Supporting Documentation
1.3 Community Engagement	*-Student work is showcased in the community* *---Participating teachers invite community members to participate in some classroom activities*	*-Community members have been identified as partners to collaborate or visit STEM teams* *---Student work is showcased in the community*	*-Community members are actively engaged in the vision and work of the program (e.g. curriculum, co---teaching, field experiences)* *---STEM teams communicate frequently and consistently with the community* *---Student work is showcased in the community*	*-Community members are partners in the leadership of the STEM program and needs assessments guide programming for the school* *---Program has engaged multiple partners to guide the work of the program* *---Opportunities exist to showcase student work through community events via on---site or online exhibitions.* *---School uses parent/community feedback to assess the STEM implementation progress* *School provides community awareness opportunities for parents*	

Essential STEM School Standard 1.5: Technology Resources

– Infrastructure: STEM programming requires leadership teams that collaborate and engage in dialogue frequently about the STEM program's design and effectiveness. Teachers are highly collaborative and community members are stakeholders in decision---making. Is a structure in place that supports the program's mission, vision, and goals?					
Key Element	**Initial Implementation**	**Developing Implementation**	**Approaching Implementation**	**Full Implementation**	**Description of your program/Supporting Documentation**
1.5 Technology Resources	*-STEM teachers and students have access to technology when instruction and learning require it* *---Participating teachers use media tools to communicate activities*	*-STEM teachers and students have access to a variety of technology on a daily basis, not just limited to computers. Students need to understand the broad scope of technology.* *---Participating teachers use media tools for communication within the classroom*	*-STEM teachers and students have access to technology on a daily basis* *---A purchase/replacement plan exists to address technology needs.* *---Media tools are created and utilized to communicate internally and externally about STEM activities*	*-Student and staff technology needs are identified and addressed as part of program design* *---Technology purchases are either complete or included in a future budget* *---Teachers and students have on---demand access to maintenance or support for the use of instructional technology in the classroom.* *---Media tools are created and utilized to communicate internally and externally about STEM activities*	

Essential STEM School Standard 1.8: Equity

– Infrastructure: STEM programming requires leadership teams that collaborate and engage in dialogue frequently about the STEM program's design and effectiveness. Teachers are highly collaborative and community members are stakeholders in decision---making. Is a structure in place that supports the program's mission, vision, and goals?					
Key Element	**Initial Implementation**	**Developing Implementation**	**Approaching Implementation**	**Full Implementation**	**Description of your program/Supporting Documentation**
1.8 Equity	*---All students receive equitable access to instruction and programs* *---Students with special needs are accommodated*	*---All students receive equitable access to instruction and programs* *---All students specific needs are being met* *---Special programs have been designed encourage underrepresented students to develop interest in STEM careers*	*---All students receive equitable access to instruction and programs* *---All students specific and identified needs are being met* *---Special programs have been designed encourage underrepresented students to develop interest in STEM careers* *---Teachers receive professional development o cultural an gender differences to inform instruction* *---Student demographics are o par with the district or community*	*---All students receive equitable access to instruction and programs* *---All students with specific an identified needs are being accommodated* *---Special programs have been designed encourage underrepresented students to develop interest in STEM careers* *---Teachers receive professional development o cultural an gender differences to inform instruction* *---STEM classroom is differentiated to accommodate all students, with special consideration made for girls and students of color* *---Student demographics in STEM are o par or in greater percentage than the district or community*	

STEM Implementation Rubric – Instruction –

2 – Instruction: <u>Does the instruction environment provide time and professional development for educators to develop and improve their craft of pedagogy and content</u>? Students in a STEM school engage in inquiry based learning that may include authentic problems. Classrooms are facilitated by teachers who are highly effective in this type of instruction and require professional development and collaboration time to help develop and improve their craft of pedagogy and content. In addition, teachers consistently use and model technology in classroom instruction and use creative assessment opportunities like science fair, portfolios, labs, debate, etc.

INDIANA DEPARTMENT OF EDUCATION STEM ATTRIBUTES	Initial IMPLEMENTATION	Developing IMPLEMENTATION	Approaching IMPLEMENTATION	FULL IMPLEMENTATION
2.1 Instructional Programming				
2.2 Integrated STEM				
2.3 Professional Development				
2.4 Instructional Technology				
2.5 Instructional Strategies				
2.6 Teacher Content Knowledge				

Essential STEM School Standard 2.3: Professional Development

– Instruction: Students in a STEM program engage in science and mathematics taught through the integration of engineering design, technological design, and mathematical analysis delivered through inquiry or project---based and/or problem---based learning grounded in real---world issues. Integrated STEM PBLs also bring in Language Arts/English and Social Studies in an interdisciplinary approach to delivering instruction. Classrooms are facilitated by teachers who are highly effective who receive ongoing professional development time for collaboration to further refine their pedagogical content knowledge. In addition, teachers infuse technology in classroom instruction as well as in creative assessment opportunities.					
Key Element	**Initial Implementation**	**Developing Implementation**	**Approaching Implementation**	**Full Implementation**	**Description of your program/Supporting Documentation**
2.3 Professional Development	*--STEM teachers participate in whole group, i.e. all STEM teacher PD that aligns with STEM initiatives, which includes inquiry and PBL practices.* *---PD includes support across the school year during implementation of strategies.*	*---STEM teachers participate in whole-group PD that aligns with STEM initiatives, which includes inquiry and PBL practices* *PD includes support across the school year during implementation of strategies.*	*--- STEM teachers participate in whole-group PD sessions focused on developing integrated curriculum, building teacher, content knowledge and effective pedagogy (e.g. PBL, inquiry)* *------STEM teachers observe colleagues and engage in formal reflection and discourse regarding practice* *---PD sessions align with the needs of the program/school and student learning needs.* *--- PD includes support across the school year during implementation of strategies.* *---Teachers are provided 40 or more hours of professional development each year*	*--Teachers have the opportunity to develop individualized PD plans and the school/program partners with higher education to find opportunities for teachers that fit within their individualized plans.* *STEM teachers participate in whole---group PD sessions focused on developing integrated curriculum, building teacher, content knowledge and effective pedagogy (e.g. PBL, inquiry)* *------STEM teachers observe colleagues and engage in formal reflection and discourse regarding practice* *---PD sessions align with the needs of the program/school and student learning needs.* *--- PD includes support across the school year during implementation of school based STEM strategies.* *---Teachers are provided 40 or more hours of PD each ye*	

STEM Implementation Rubric – Curriculum –

3 – Curriculum: Is your STEM curriculum aligned to the adopted Indiana Academic Standards? Courses/Classes are integrated across content and infused with community needs and content progresses from grade to grade and are aligned across content areas.

INDIANA DEPARTMENT OF EDUCATION STEM ATTRIBUTES	Initial IMPLEMENTATION	Developing IMPLEMENTATION	Approaching IMPLEMENTATION	FULL IMPLEMENTATION
3.1 Curriculum Integration				
3.2 Curriculum Progression and Alignment				
3.3 Community Engagement				
3.4 21st Century Skills (http://www.p21.org/)				
3.5 Student Performance Assessments				

Essential STEM School Standard 3.5: Assessments

– Curriculum: A STEM curriculum design is aligned to the adopted Indiana Academic Standards. Courses/Classes are integrated across content and infused with community needs and also progress naturally from subject to subject, grade to grade.					
Key Element	**Initial Implementation**	**Developing Implementation**	**Approaching Implementation**	**Full Implementation**	**Description of your program/ Supporting documentation**
3.5 Assessments	*-Performance based assessments are used to monitor student learning ---State---wide data is used to drive instructional practices*	*-Performance based and pre/post assessments are used to monitor student learning ---Student observations are included as an assessment tool ---State---wide data is used to drive instructional practices*	*-Teachers use performance based assessments to determine student learning ---Pre/Post assessments are used to show student growth ---Non---traditional assessments are used to monitor student processes ---State---wide data is used to drive instructional decisions. ---Teachers use observation and monitor student dialogue to assess student processes in problem solving and innovation.*	*-Teachers use performance---based assessments to determine student learning --- Pre/Post Assessments are used to show student growth ---Teachers use observation and monitor student dialogue to assess student processes in problem solving and innovation. ---Students participate in self---evaluation and goal setting consistently ---School uses data from State---wide and school assessments to drive instructional decisions and RTI opportunities.*	

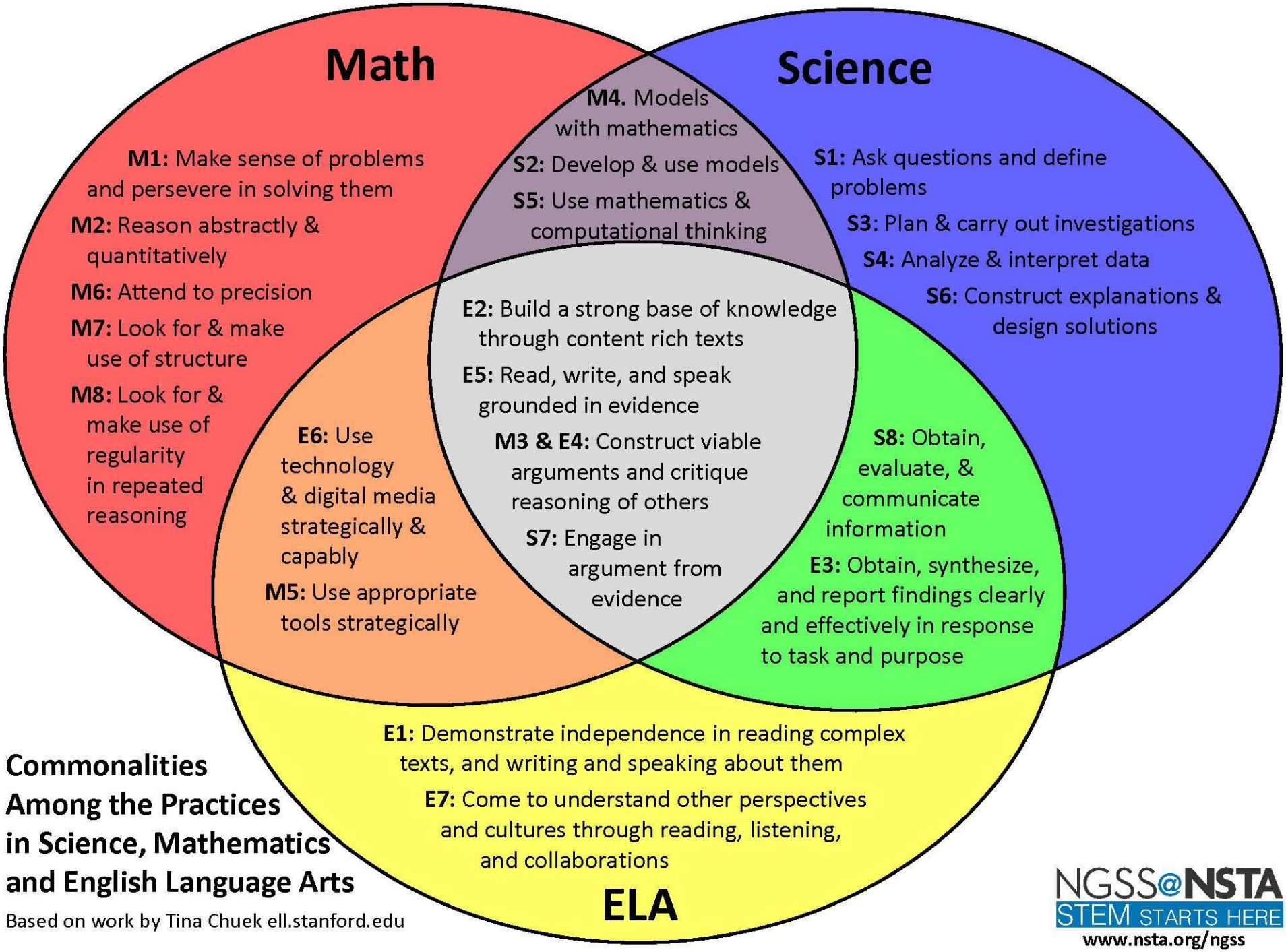
STEM Implementation Rubric
– Extended Learning –

4 - Extended Learning: <u>Does the STEM program offers opportunities outside the school day?</u> STEM program offers opportunities outside the school day that may or may not be held at the school. There are multiple opportunities for students to extend their STEM learning, but the program has a strong connection to the school curriculum and activities that lie within and processes to maintain connections.

INDIANA DEPARTMENT OF EDUCATION STEM ATTRIBUTES	Initial IMPLEMENTATION	Developing IMPLEMENTATION	Approaching IMPLEMENTATION	FULL IMPLEMENTATION
4.1 Programming				
4.2 Program Alignment				
4.3 Community Engagement				

Essential STEM School Standard 4.3: Community Engagement

--- Extended Learning: STEM program offers opportunities outside the school day that may or may not be held at the school. There are multiple opportunities for students to extend their STEM learning, but the program has a strong connection to the school curriculum and activities that lie within.					
Key Element	**Initial Implementation**	**Developing Implementation**	**Approaching Implementation**	**Full Implementation**	**Description of your program/ Supporting Documentation**
4.3 Community Engagement	*-STEM practitioners are utilized to extend student learning* *---Student work is displayed within the school or community*	*--- STEM practitioners are utilized to extend student learning* *---Student work is displayed within the school or community*	*--- STEM practitioners are regularly invited to participate in extended learning opportunities for students.* *---Student work is exhibited an displayed in the community and on the school website* *---Students participate in community events to share program activities*	*-Students have direct experiences with STEM professionals in authentic environments outside the school day* *---Student work is exhibited and displayed in the community an o the school website.* *---Students participant in community events to share program activities an is directly related to STEM*	



Commonalities Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek ell.stanford.edu

NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

Integrating Math and Science

- Integrating science and math helps provide relevance and purpose to math
- Less fragmented content
- More stimulating for students
- Ensures Science is being taught at all levels.
- Requires strong collaboration between math and science teachers.
- Both math and science processes are addressed

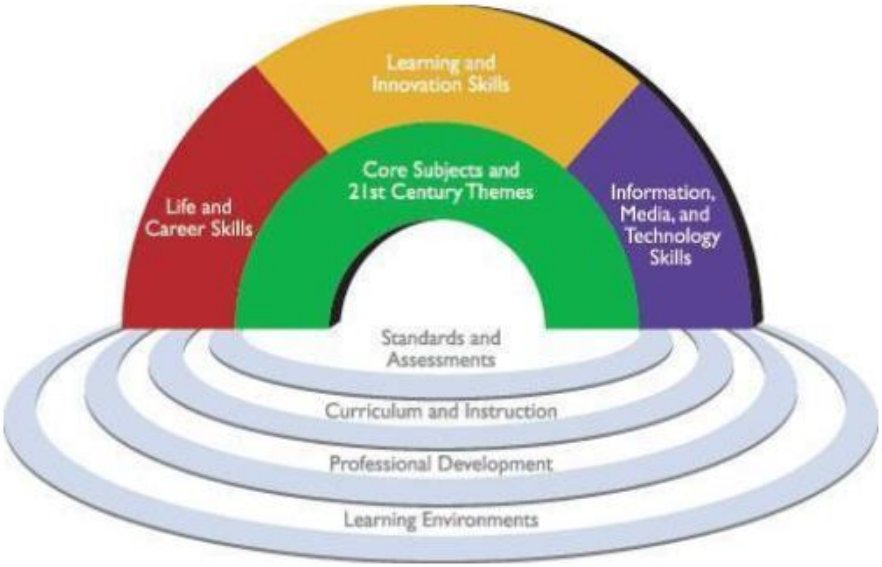
The process standards are:

- The **behaviors** needed to be successful in math and science
- The processes used to **apply** content knowledge
- Essential to embed into **daily** instruction
- Opportunities that help students **think and behave** like scientists and mathematicians
- The **“doing”** of science and math

Process Standards

P21 Framework

www.P21.org



- Creativity
- Critical Thinking
- Collaboration
- Communication

- Media Literacy
- Information Literacy
- Information Communication Technology Literacy

- Productivity & Accountability
- Leadership & Responsibility
- Flexibility & Adaptability
- Social & Cross Cultural Skills
- Initiative & Self Direction

- Environmental Literacy
- Global Awareness
- Financial Literacy
- Health Literacy
- Civic Literacy

Questions?

Thank You!

Please feel free to contact a STEM Coordinator with any questions and/or to discuss your school.

General Questions	Jeremy Eltz, Ph.D., jeltz@doe.in.gov Asst. Director of College and Career Readiness
Elementary	Nick Flowers, nflowers@doe.in.gov Elementary Math, Science, and STEM Specialist
Middle School	Jarred Corwin, jcorwin@doe.in.gov Secondary Science and STEM Specialist
High School	Bill Reed, wreed@doe.in.gov Secondary Math and STEM Specialist